AMENDMENTS TO THE CLAIMS

The listing of claims below replaces all prior versions of claims in the application.

1-14. (Canceled)

15. (New): A semiconductor device for molecular electronics as well as molecular electronics-based biosensor applications, comprising:

a semiconductor hetero-structure consisting of a material stack of two undoped layers of material A separated by a doped layer of different semiconductor material B or a different composition in case of compound semiconductors, the semiconductor hetero-structure having conductive source and drain electrodes on the undoped layers of material A which are separated by a groove-like nano-gap,

wherein the conductive source and drain electrodes are situated on a selectively etched cleavage plane oriented perpendicular to the hetero-structure layer plane, and the groove-like nano-gap is bridged by one or more conductive organic wires which are organic molecules with a conjugated π-electron system or DNA oligonucleotides being connected with the conductive source and drain electrodes of the semiconductor hetero-structure.

16. (New): A semiconductor device according to claim 15, wherein the one or more organic wires are further functionalized with receptors for biomolecular recognition or receptors made of biomolecules which recognize bioactive molecules like hormones, polysaccharides,

lipids or drugs such that the semiconductor device can be employed as highly sensitive electrical biosensor for the detection, analysis and quantification of specific biomolecules and their mutual interaction.

17. (New): A semiconductor device as in claim 15 or 16, wherein the doped layer, which has been selectively etched, fulfils the function of a field effect gate electrode when operating the semiconductor device as a molecular electronics or molecular electronics-based biosensing device.

18. (New): A semiconductor device as in claim 15, wherein the wires consist of molecules of a length which is the same as or exceeds the gap and which are terminated by chemical endgroups able to covalently bind to the source and drain electrodes.

19. (New): A semiconductor device as in claim 16, wherein the wires consist of molecules of a length which is the same as or exceeds the gap and which are terminated by chemical endgroups able to covalently bind to the source and drain electrodes.

20. (New): A semiconductor device as in claim 17, wherein the wires consist of molecules of a length which is the same as or exceeds the gap and which are terminated by chemical endgroups able to covalently bind to the source and drain electrodes.

21. (New): A semiconductor device as in claim 16, wherein a selective binding of a bio molecular analyte to the organic nanowire changes the receptor's electron affinity towards the wire thus modifying its delocalized electron distribution and in turn leads to a change in molecular conductance.

22. (New): A semiconductor device as in claim 15, wherein the hetero-structure material stack comprises undoped AlGaAs for the undoped layers and doped GaAs for the middle doped layer.

23. (New): A semiconductor device as in claim 15, wherein the source and drain electrodes are formed of a deposited alloy of Pd and Au.

24. (New - Withdrawn): A method of producing a semiconductor device according to claim 15, wherein the material stack being cleaved perpendicular to the layer planes and the obtained cleavage plane being subsequently selectively etched such that only the doped layer is removed deep into the cleavage plane and a metal layer is deposited on the etched cleavage plane from an angle to form the conductive source and drain electrodes.